AD-A062 467 SRI INTERNATIONAL MENLO PARK CA F/G 20/5
INELASTIC COLLISIONS OF EXCITED ATOMS.(U)
NOV 78 K T GILLEN, M J COGGIOLA N00014-76-C-0118
UNCLASSIFIED SRI-MP-78-124 NL

| OF |
AD
A062467

END
DATE
FILMED
3-79
DDC

LEVEL II

12

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): INELASTIC COLLISIONS OF EXCITED ATOMS. (14) SRI-MP-78-124	5. TYPE OF REPORT & PERIOD COVERED: Summary Questionnaire, March 1978-November 1978
7. AUTHOR(s): (10) Keith T. Gillen and Michael J. Coggiola	6. PERFORMING ORG. REPORT NUMBER / 8. CONTRACT OR GRANT NUMBER(s): (15) N000014-76-C-0118
9. PERFORMING ORGANIZATION NAME AND ADDRESS: SRI International, 333 Ravenswood Ave., Menlo Park, CA 94025	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: Office of Naval Research, 800 North Quincy St., Arlington, VA 22217	12. REPORT DATE: (11) 22 November 22, 1978 / 13. NUMBER OF PAGES: 3
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (9) Rept. for Mar-Nov 78, (12) 4p.	15. SECURITY CLASS. (of this report): Unclassified / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

DDC RECEIVED DEC 20 1978 D

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Laser-induced-fluorescence, fast beams, metastable rare gas, metastable neon, excited atom interactions, charge transfer, optical pumping

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the development and verification of a technique for optically pumping fast metastable rare gas beams in order to monitor, and then substantially alter, the beam composition. The technique has been successfully applied to a neon metastable beam produced by charge transfer of neon ions in sodium at energies near 1 keV.

78 12 11 117

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

410 281 LB

AD A062467

DDC FILE COPY

December 4, 1978
MP 78-124

SUMMARY QUESTIONNAIRE

ONR Contract N00014-76-C-0118
Inelastic Collisions of Excited Atoms

SRI Project PYU 4529

1. Contract Description

We are developing and testing methods for measuring and modifying the composition of fast metastable rare gas beams. We are initiating scattering experiments involving excited state beams of specified composition.

2. Scientific Problem

Understanding collisional interactions of excited atoms and molecules is of fundamental importance to the interpretation of phenomena in many areas of gas phase physics, including discharges, flames, lasers, and disturbed atmospheres. Little detailed fundamental data exists for reactants and products in specified internal states.

Interactions involving excited (metastable) rare gas atoms are of particular importance scientifically because of the simplicity of some of the interaction mechanisms; they are also of practical importance because of recently developed excimer lasers based on rare gas metastable interactions with various other molecules. Recent molecular beam work in several laboratories has explored interactions of metastable rare gas atoms. By suitable variation of the rare gas projectile and target species, one can explore a wide range of inelastic phenomena in a systematic manner. Each rare gas has two metastable states whose reaction properties may differ in dramatic and interesting ways. Unfortunately in a beam of unknown composition it is difficult to separate the contributions from the two states; and true

state-to-state inelastic cross sections cannot be investigated. We are tackling this problem for fast beams of the heavier rare gases.

3. Scientific and Technical Approach

A fast neutral beam (containing metastables) is merged coaxially with the output of a tunable single-mode dye laser. The laser is used to pump either the $^3P_2$ or $^3P_0$ component of the beam to a higher level. A fraction of the laser-excited atoms radiates to the $^3P_1$ or $^1P_1$ levels, which decay by uv emission to the $^1S_0$ ground state. By monitoring the laser-induced uv emission, we can determine the composition of the excited state beam. By repeated excitation of those pumped atoms that return to the original state, we can deplete that state from the beam, leaving an atom beam which contains only one metastable state in addition to the ground state. This beam can then be used to explore true state-to-state inelastic and reactive processes in collisions with various targets.

4. Progress

We have constructed and tested an apparatus for experimental investigations involving purified, single-state metastable atom beams. We have measured the composition of a Ne^* beam formed by charge transfer of Ne^+ in Na at energies from 800 to 1300 eV. A paper based on this work has been submitted recently to the Journal of Chemical Physics. We have successfully purified a Ne^* beam of one, then the other, metastable state. A paper is being written for submission to The Review of Scientific Instruments detailing the experimental procedure and the beam purification results.

5. Publications

(a) "Metastable Rare Gas Collisions at Intermediate Energies (5-3000 eV)", chapter by K. T. Gillen, in Electronic and Atomic Collisions, Proceedings of the Tenth International Conference on the Physics of Electronic and Atomic Collision, Invited Papers and Progress Reports, G. Watel, Ed. (North Holland Publishing Company, Amsterdam, 1978), pp. 473-492.

(b) "Determination of Neon Metastable Beam Composition," M. J. Coggiola, T. D. Gaily, K. T. Gillen, and J. R. Peterson, submitted to J. Chem. Phys. (Nov. 1978).

(c) "Determination of Neon Metastable Beam Composition," M. J. Coggiola, T. D. Gaily, K. T. Gillen, and J. R. Peterson, 1978 Meeting of Division of Electron and Atomic Physics of the American Physical Society, Nov. 1978, Abstract of scheduled talk.

6. Extenuating Circumstances

None

7. Personnel

The following SRI personnel have participated in the scientific work accomplished in the past year under the contract: M. J. Coggiola, G. M. Conklin, T. D. Gaily, K. T. Gillen, R. L. Leon, and J. R. Peterson. T. D. Gaily participated in this work while on sabbatical from the Physics Department of Western Ontario University.

8. Graduate Student Degrees

No graduate students participated in this work.